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(71) Applicant(s)
UWG Limited

(Incorporated in the United Kingdom)

1 Chalk Hill House, 19 Rosary Road, NORWICH, NR1 1SZ, United Kingdom

(72) Inventor(s)
Mark Boyd
Richard Higham
Ian McFadyen
Richard Hall

(74) Agent and/or Address for Service
Sanderson & Co
34 East Stockwell Street, COLCHESTER, Essex, CO1 1ST, United Kingdom

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(56) Documents Cited
GB 2179079 A GB 2171436 A US 4984633 A
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(54) Casing centraliser

(57) A cementing casing centraliser for use in oil or gas drilling operations, comprises a cylindrical body 10 having a bore whereby the body may be mounted on a casing. The external surface of the body has a plurality of projections 13, arranged in three circumferential rows 14, 15 and 16. The projections all have the same radial extent, and the projections of the two end rows 14 and 16 are axially aligned. The projections of the central row 15 are out of phase with those of the two end rows, and to each side of any projection, there is a linear path parallel to the body axis which path is clear of all projections. Two other embodiments are described with projections having cross sections different to that of projections 13.

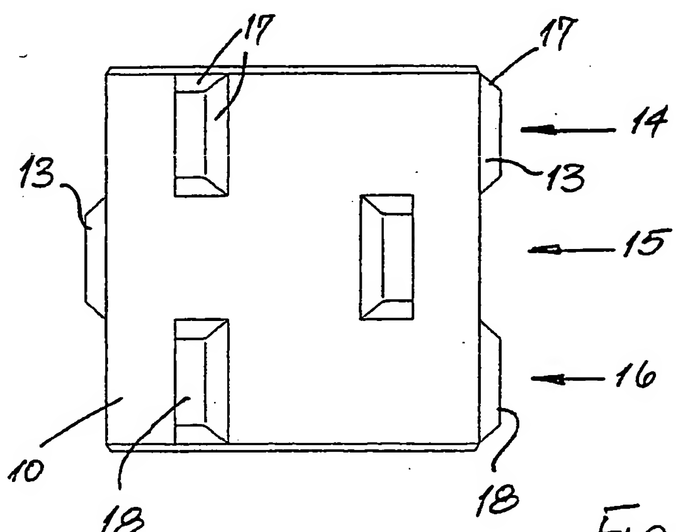

FIG 2

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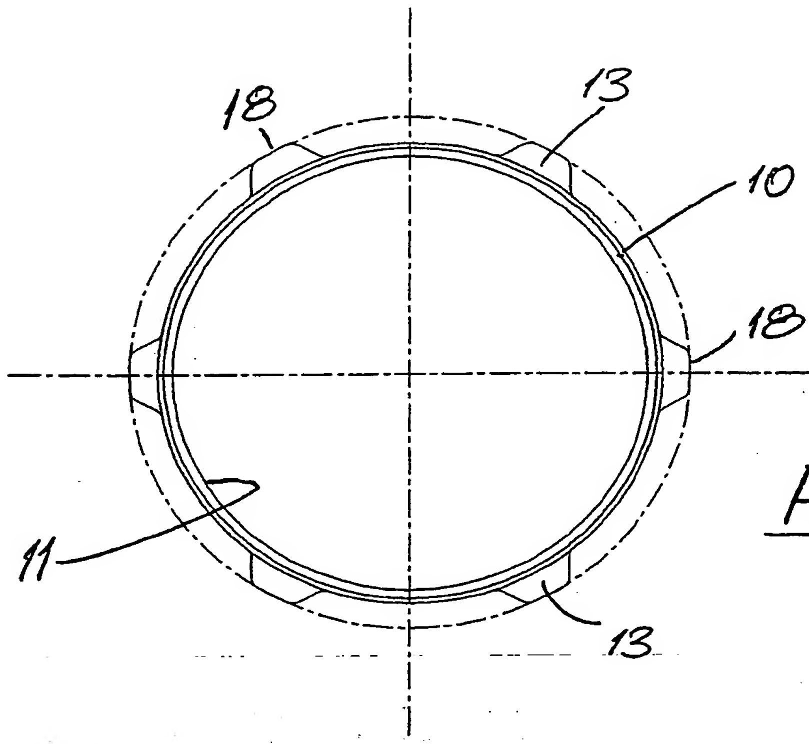

Fig 1

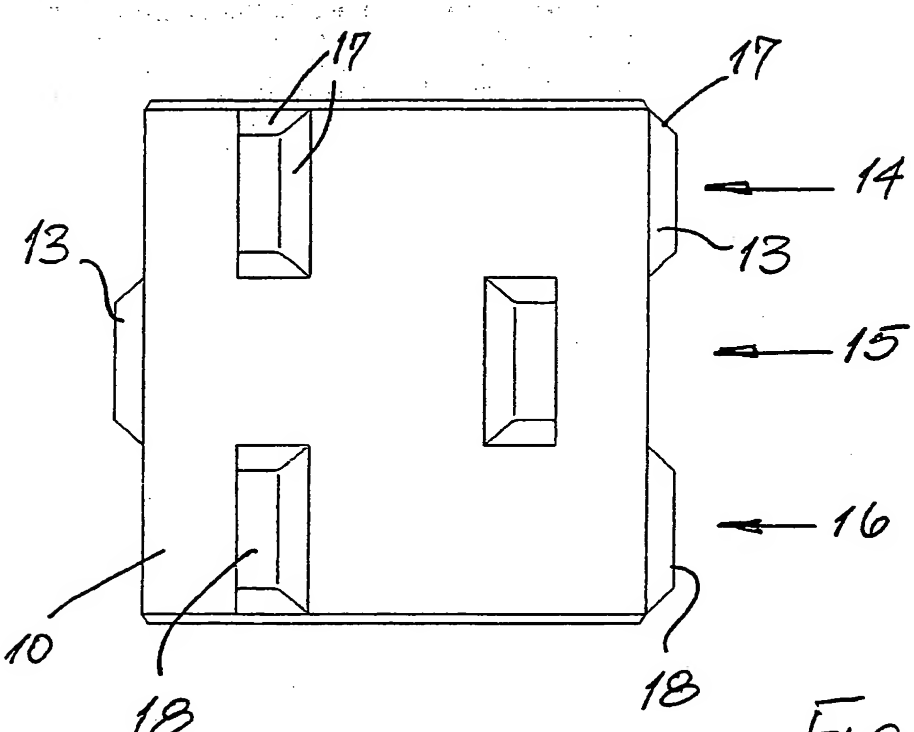

Fig 2

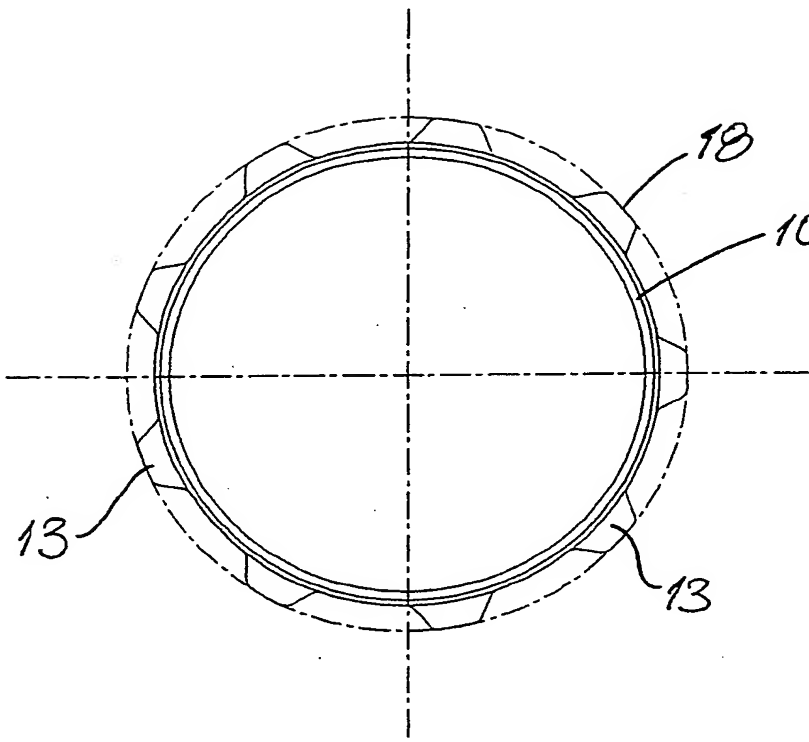

Fig 3

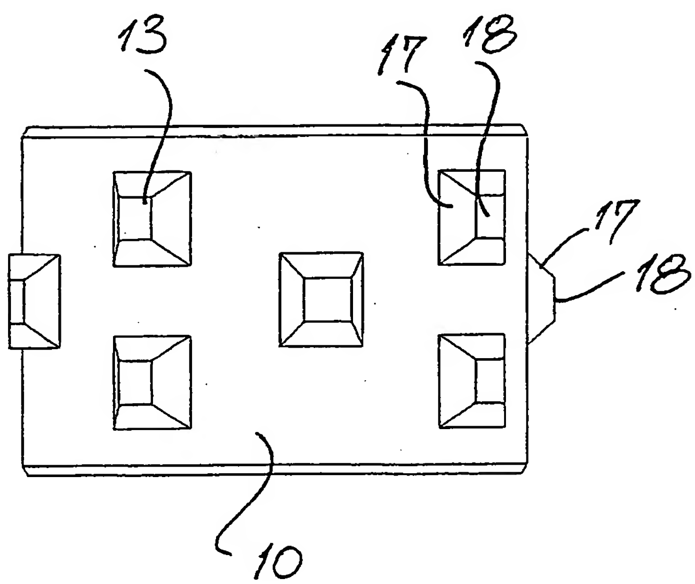

Fig 4.

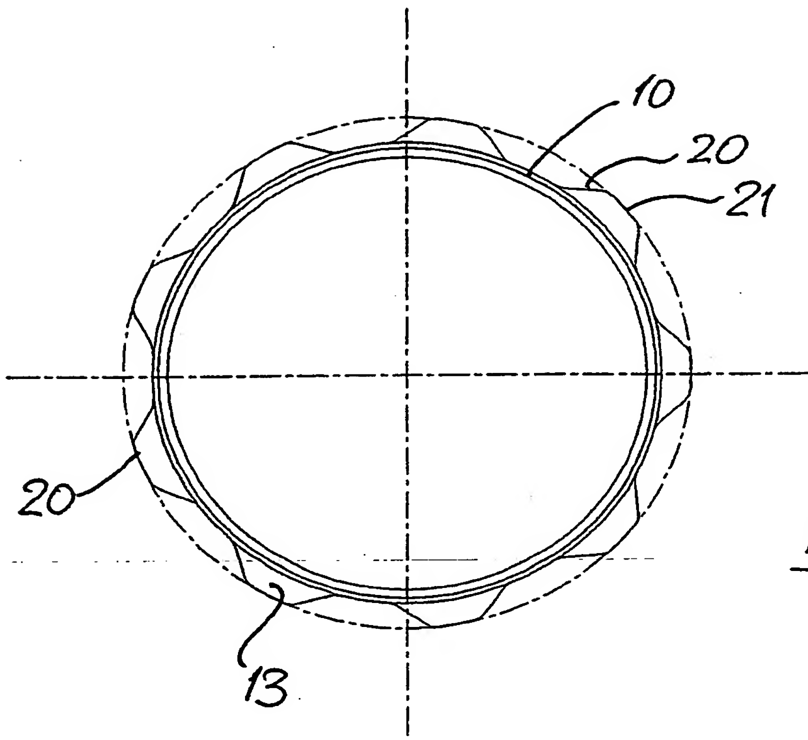

Fig 5

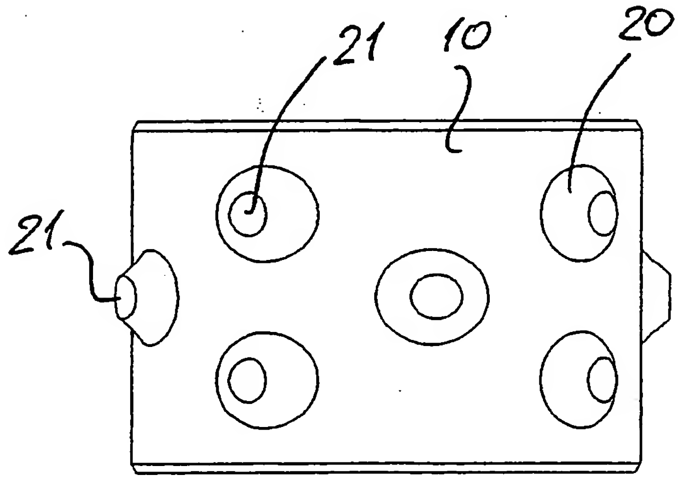

Fig 6

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CASING CENTRALISER

This invention relates to a casing centraliser, and in particular - though not exclusively - to a so-called cementing casing centraliser.

When a hole is drilled into the ground, for example for the exploration or exploitation of subterranean hydrocarbon deposits, it is the usual practice to run a tubular steel casing into the hole, to provide structural stability and to control the pressures from the penetrated strata. After a casing string has been run into the hole, cement is normally pumped into the annulus between the casing and the hole, both to enhance structural stability and to act as a seal against rock formation pressure. Hence it is very important that an even distribution of the cement is achieved around the casing and that, wherever possible, channels through the cement after setting are avoided in order that a hydraulic seal between the casing and the formations can be obtained.

Should a hole be drilled with sections at an angle to the vertical, there is a natural tendency for the casing string to lie on one side of the hole and this makes uniform cementing difficult. To overcome this problem, centralisers are often used on the casing to ensure that the casing is at least generally concentric with the hole itself.

A centraliser comprises a cylindrical body adapted for mounting externally of the casing string, and has fins or blades projecting from that body to achieve the required centralisation, whilst allowing cement to flow past that centraliser. There are two generic types of centraliser in general usage - namely, spiral-bladed and straight-bladed. These are usually of cast aluminium alloy construction, though may be made from steel. Both types may be affixed to a casing in a variety of ways, including: (1) by set screws located in threaded holes formed in the centraliser body or a blade; (2) between a stop collar and a casing coupling; (3) between two stop collars; or (4) between casing couplings, which may typically be about 12m apart. Though with the first method, a centraliser is secured against rotation with respect to the casing, the second, third and fourth methods allow independent rotation of the centraliser on the casing. The fourth method also allows a centraliser to move to a limited extent along the casing string.

A spiral bladed centraliser ensures better stand-off than an equivalent straight-bladed centraliser, because in the former type, the blades cover the entire circumference of the pipe, whereas the straight blades do not, and this can lead to a decreased stand-off distance. It is also claimed that a spiral-bladed design promotes turbulence in the flow of cement, to

minimise channelling through that cement, when set. The promotion of mixing tends to afford more efficient and uniform displacement of the "mud" (pressure control fluid) by the cement.

By contrast, a disadvantage associated with the spiral design is that there may be a "ploughing" effect in which hole material is dislodged and locates between the centraliser blades, leading to plugging of the hole by the centraliser. Moreover, there is likely to be an increased pressure drop across a spiral-bladed design, which pressure drop may become significant should a large number of spiral-bladed centralisers be employed.

Though a straight-bladed centraliser avoids the above disadvantages, the fact that the blades are not circumferentially continuous allows by-pass of hole material. Moreover, a straight-bladed centraliser cannot promote turbulence in the cement and so it may be expected that there will be a less efficient cementing, together with increased channelling and poorer mud displacement by the cement.

It is an aim of the present invention to provide a casing centraliser which overcomes the above-described disadvantages of both straight-bladed and spiral-bladed centralisers, and so which, when in use, adequately supports a casing within a drilled hole and allows an efficient cementing operation to take place.

According to the present invention, there is

provided a casing centraliser comprising a cylindrical body and a plurality of discrete projections upstanding from the external surface of the body, the projections being distributed over the external surface of the body and being spaced from one another in both the circumferential and axial directions.

It will be appreciated that with the casing centraliser of this invention, support for a casing may be obtained at least substantially around, if not wholly around, a casing in the circumferential direction. Moreover, by having a plurality of projections distributed in both the circumferential and axial directions, there will be at least some turbulence caused as cement is pumped past the centraliser, so leading to efficient cementing and displacement of mud by that cement.

When centralisers are used around a casing string inserted into a hole with the intention of cementing the annular space between the hole and the casing, the centralisers are usually referred to as "cementing casing centralisers". Though the centralisers of this invention are primarily intended to be used in this way, they could be used just to hold an inner string spaced from an outer string; as such, there would be no cementing operation.

Preferably, the projections are arranged in at least two - but typically three - circumferential rows,

the projections of one row being arranged in an out-of-phase disposition with respect to the projections of the other row. If three circumferential rows of projections are provided, then it is preferred that the projections of the two outer circumferential rows are in phase, but out of phase with respect to the projections of the central row.

In order to minimise that pressure drop across a casing centraliser of this invention, it is preferred that there be a linear path parallel to the body axis and clear of all projections to each side of any projection in any circumferential row thereof. As a consequence, in a complete centraliser, there will be a plurality of parallel linear paths for the cement which thus may flow relatively freely past the centraliser. Nevertheless, the distributed arrangement of the projections will still serve to cause at least some turbulence in the cementing flow.

Though it is envisaged that all of the projections will have substantially the same overall radial height, from the external surface of the body, nevertheless in some circumstances there may be advantages in having some of the projections of a lesser radial height than the others. In such a case, the projections of a lesser height should be distributed amongst those of the greater height.

The projections may take any of a wide variety of

shapes and forms, though normally all of the projections on one centraliser will be of the same shape and form. The sides of each projection may be substantially parallel, or may taper together, in the radially outward direction. Preferably, each projection has a radially outer surface which is substantially flat, though it may be curved with a radius of curvature centred on the axis of the centraliser body. By having a broad outer surface, there is a good bearing surface against the side wall of the drilled hole and the likelihood of ploughing is reduced.

Each projection may have a circular cross-sectional shape, in which case each projection may be of frusto-conical form. In a preferred embodiment, each projection is of square or rectangular cross-sectional shape, in which case each projection is of square or rectangular truncated pyramidal form.

A centraliser of this invention may be located in the required position on a casing string by any of the methods discussed above, in connection with conventional straight-bladed or spiral-bladed centralisers.

By way of example only, three specific embodiments of casing centraliser of this invention will now be described in detail, reference being made to the accompanying drawings in which:-

Figure 1 is an axial end view on the first embodiment of casing centraliser;

Figure 2 is a side view of the centraliser of Figure 1;

Figures 3 and 4 are respectively axial end and side views of a second embodiment of casing centraliser; and

Figures 5 and 6 are respectively axial end and side views of a third embodiment of casing centraliser.

Referring initially to Figures 1 and 2, there is shown a first embodiment of casing centraliser of this invention which comprises a cast aluminium alloy body 10 of cylindrical form and defining a bore 11 which is adapted to be a close sliding fit on a casing of a given size. Projecting from the external surface 12 of the body 10 is a plurality of projections 13, arranged in three circumferential rows, as shown by arrows 14, 15 and 16 on Figure 2.

Each projection 13 is of rectangular cross-sectional shape and is defined by tapering side walls 17 together with an outer surface 18 which is curved in the circumferential direction with a radius of curvature centred on the axis of the body 10, but which outer surface 18 is linear in the direction parallel to the body axis.

As will be appreciated from Figure 2, the projections of the two outer rows 14 and 16 are in

phase, but out of phase with the projections of the central row 15. Moreover, to each side of any projection, there is a linear path parallel to the body axis, which is clear of all projections.

Figures 3 and 4 show a second embodiment of casing centraliser, similar to that of Figure 1 and like parts are given like reference characters; those parts will not be described in detail again here. The centraliser of Figures 3 and 4 differs from that of Figures 1 and 2 in that the centraliser has a lesser axial length, and a greater number of projections 13 in each circumferential row thereof. As a consequence, the cross-sectional dimensions of each projection are smaller than those of the centraliser of Figures 1 and 2 - and in the illustrated second embodiment, those projections are of square cross-sectional shape.

Again, in this second embodiment, the projections of the two outer rows thereof are in phase but out of phase with the projections of the central row. Also, there is a linear path clear of all projections, to each side of any given projection on the body.

The embodiment of centraliser shown in Figures 5 and 6 is of similar dimensions to that shown in Figures 3 and 4, and again like parts are given like reference characters. In this third embodiment, each projection is of circular cross-sectional shape, and so is of general frusto-conical form; as such, each projection

is defined by a part-conical side wall 20, together with an outer surface 21 which outer surface is again curved in the circumferential direction, with a radius of curvature centred on the axis of the centraliser body, but is linear in the axial direction.

Each of the three embodiments of casing centraliser described above may be cast in one piece, with the projections moulded integrally with the body. When in use, the selected design of centraliser may be mounted on a casing by any of the conventional methods employed with previously-known forms of centraliser. However, the described embodiments of centraliser provide better centralisation than would be achieved with a conventional straight-bladed centraliser, and moreover will introduce turbulence into cement pumped passt the centraliser. However, the pressure drop passt the centraliser will be maintained at a low level and also the ploughing problem associated with spiral-bladed centralisers will be obviated.

CLAIMS

1. A casing centraliser comprising a cylindrical body and a plurality of discrete projections upstanding from the external surface of the body, the projections being distributed over the external surface of the body and being spaced from one another in both the circumferential and axial directions.

2. A casing centraliser according to Claim 1, wherein the projections are arranged in two circumferential rows, the projections of one row being arranged in an out-of-phase disposition with respect to the projections of the other row.

3. A casing centraliser according to Claim 1, wherein the projections are arranged in three circumferential rows, the projections of the two outer circumferential rows being in phase, but out-of-phase with respect to the projections of the central row.

4. A casing centraliser according to any of the preceding Claims, wherein there is a linear path parallel to the body axis and clear of all projections to each side of any projection in any circumferential row thereof.

5. A casing centraliser according to any of the preceding Claims, wherein all of the projections have substantially the same overall radial heights, from the external surface of the body.

6. A casing centraliser according to any of the preceding Claims, wherein all of the projections upstanding from the body are of the same shape and form.

7. A casing centraliser according to any of the preceding Claims, wherein the sides of each projection taper together, in the radially outward direction.

8. A casing centraliser according to any of the preceding Claims, wherein each projection has a radially outer surface which is substantially flat.

9. A casing centraliser according to Claim 8, wherein the radially outer surface of each projection is curved with a radius of curvature centre on the axis of the centraliser body.

10. A casing centraliser according to any of the preceding Claims, wherein each projection has a circular cross-sectional shape, and is of frusto-conical form.

11. A casing centraliser according to any of Claims 1 to 9, wherein each projection has a square or rectangular cross-sectional shape, and is of square or rectangular truncated pyramidal form.

12. A casing centraliser as hereinbefore described, with reference to and as illustrated in any of Figures 1 and 2 or Figures 3 and 4, or Figures 5 and 6 of the accompanying drawings.

Examiner's report to the Comptroller under Section 17 (The Search report)	GB 9320845.2
Relevant Technical Fields (i) UK Cl (Ed.N) E1F FAC (ii) Int Cl (Ed.6) E21B	Search Examiner MR D B PEPPER
	Date of completion of Search 4 JANUARY 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WORLD PATENTS INDEX	Documents considered relevant following a search in respect of Claims :- 1 TO 12

Categories of documents

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X, Y	US 4595058	(NATIONS)	X: 1, 2, 5, 6, 8 Y: 7
X, Y	US 4467879	(BURGE)	X: 1, 3, 5, 9 Y: 7
Y	US 4984633	(LANGER ET AL)	7
A	GB 2179079 A	(WILLIAM HUNT ENGINEERS)	1
A	GB 2171436 A	(R F MIKOLAJCZYK)	1

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